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On the Performance of Nominal Income Targeting as a Strategy for Monetary Policy in a Small Open Economy

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ABSTRACT

There is a great deal of support for nominal income targeting in the literature on strategies for monetary policy in a closed economy framework. Is nominal income targeting equally attractive in a small open economy? This paper compares nominal income targeting to alternative monetary policy rules in a stochastic macro model for a small open economy. We find that both, the weighting in the overall price level of the exchange rate and foreign prices and the elasticity of output supplied with respect to the real exchange rate, are important factors in assessing the attractiveness of nominal income targeting. In a small open economy where the size of both parameters is not negligible, a rule targeting the overall price level may actually be preferred to nominal income targeting.

JEL Classification Codes: E52, F41

Introduction

The adoption of inflation targets by a number of central banks during the past decade seems to run counter to the policy advice spelled out in the literature on monetary policy strategies. There appears to be a reasonably strong consensus in the literature that favours nominal income targeting as the most suitable monetary policy strategy.[1] Thus the decision by countries like Canada, New Zealand, Sweden, the United Kingdom and others to target inflation directly, and the long-standing implicit form of inflation targeting pursued by Germany, Switzerland, Japan, and arguably the United States, is surprising to readers of the academic literature, and in fact at odds with conventional wisdom. The divergence between what the literature hails as the most suitable object of monetary policy and actual practice highlights the need for reassessing the argument for nominal income targeting.

In our view, the argument for nominal income targeting must be reassessed for small open economies. Much of the existing literature has focused on relatively closed economies.[2] However, all of the economies that have adopted an explicit inflation target are (relatively) open economies. There is thus reason to believe that the attractiveness of nominal income targeting in a closed economy may not carry over in full force to a small open economy.

The evaluation of policy rules for closed economies has mainly focused on the attainment of domestic price and output stability. A small open economy has additional considerations. The stability of the exchange rate is important. Instability in the exchange rate leads to undesirable fluctuations in the pertinent price level, usually represented by a measure of prices of both domestic and foreign goods such as the Consumer Price Index. In addition, the degree of import penetration or openness is another factor that influences the choice of a strategy for monetary policy in a small open economy.

In the existing literature on nominal income targeting, a few contributions[3] do acknowledge the importance of the exchange rate in model specification and evaluation, but overall price level considerations and the degree of openness have not been addressed explicitly. In effect, this oversight has important implications for the accuracy of any assessment of the merits of nominal income targeting.

This paper seeks to redress this oversight by examining the properties of nominal income targeting vis-à-vis exchange rate, overall price level, and money supply targeting in the context of a small open economy. The role of the overall price level and other pertinent features such as openness and the sensitivity of aggregate supply to real exchange rate movements are emphasised in both model specification and evaluation. Doing so captures important aspects of small open economies that need to be recognized in the analysis of policy rules. Indeed, the findings reported in this paper provide an insight as to why small open economies may prefer inflation targeting to nominal income targeting. The appeal of inflation targeting is largely attributable to the fact that the strict adherence to a nominal income targeting rule may cause excessive fluctuations in the exchange rate and thus in the overall price level. These fluctuations become more pronounced under nominal income targeting as the degree of openness and the sensitivity of aggregate supply to swings in the real exchange rate increase.

The paper begins with a review of the arguments for nominal income targeting before discussing why such arguments may not necessarily apply to small open economies. Section III introduces the small open economy model used in the paper. Section IV discusses the criteria used in evaluating the performance of a particular monetary policy rule. This section also contains a graphical analysis of the properties of the different monetary policy rules

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[1] Hall and Mankiw (1994) argue that there exists a professional consensus that nominal income is the most suitable object of monetary policy, p77. This consensus is perhaps more evident in the United States, where economy is rather closed, than in other parts of the world.

[2] For example, Taylor (1985), McCallum (1988), Hall and Mankiw (1994).

considered in the paper. The last part of Section IV attempts to reconcile our findings with inflation targeting in practice. Section V concludes.

II. Nominal income targeting: closed vs open economy framework

Nominal income targeting has had an enduring popularity in the literature as the most appropriate policy target for monetary policy in a closed economy. Its support has spanned from the late 1970s, with early contributions from Meade (1978) and Tobin (1980), to the present day. At present, nominal income targeting has support from all branches of modern macroeconomics, from schools of thought espousing monetary neutrality to those favouring monetary non-neutrality.[4]

Advocates of nominal income targeting point out that it stabilises prices just as effectively as inflation targeting while offsetting cyclical shocks more effectively. The latter is due to the relative speed with which output adjusts to monetary policy actions compared to prices. The design of a nominal income target is arguably easier than that of an inflation target, as unlike inflation targeting, there is no need to extract from nominal GDP growth the relative inflation and real growth components.[5] Strong theoretical support for nominal income targeting in the closed-economy context has been given by Hall (1985), Frankel and Chinn (1995), and McCallum (1995).[6] There has been strong support from the empirical literature for nominal income targeting as well, including Taylor (1985), McCallum (1988), Henderson and McKibbin (1993), Bryant, Mann and Hooper (1993), and Hall and Mankiw (1994).[7]

Recent contributions by Frankel and Chinn (1995), Ratti (1997), and McCallum and Nelson (1999) claim that the merits of nominal income targeting carry over to the open

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[3] Such as Genberg (1989), Rodseth (1996), and Froyen and Guender (2000), to name a few.

[4] As pointed out by Hall and Mankiw (1994), p74, under full monetary neutrality, stable nominal income will result in stable prices (assuming stable real output). Under monetary non-neutrality, the targeting of nominal income is an intermediate solution to the question of how should monetary policy respond to a shock to the price level.

[5] The above merits of nominal income targeting are discussed by McCallum (1995).

[6] The theoretical literature has been generally in favour of nominal income targeting, although different model specifications have provided different degrees of support. The degree of support has been closely linked with a particular model's specification of aggregate supply, as demonstrated by Bean (1983), West (1986), Jansen and Kim (1993), and Ball (1997). The last two contributions, unlike Bean and West, aver that nominal income targeting may in fact be destabilising, not stabilising. See McCallum (1997) for a discussion of the robustness of nominal income targeting under different specifications of the aggregate supply relation.

[7] An exception is Fair and Howrey (1996) who use an optimal control technique to find a target for inflation outperforming a nominal income target in five different models.

economy. The latter find that nominal income targeting performs well in relation to inflation targeting and Taylor rules.[8]

However, nominal income targeting has its critics in policy circles inside and outside of academia. Svensson (1997) and Ball (1997) elaborate on a few important undesirable features of nominal income targeting in a dynamic framework. Reservations are also expressed by Poole (1980) who argues that nominal income targeting leaves too much discretion in the hands of authorities. Mayer (1990) comments on how nominal income targeting requires the assumptions that the central bank uses information efficiently and acts in the public interest, which are both issues of contention. Blinder (1997) emphasises practical difficulties in nominal income targeting, namely the timeliness of information on nominal GDP and the potential for misconstruing a nominal GDP goal as a real GDP goal. Nominal income targeting thus appears in a less favourable light if ease of implementation and interpretation are important criteria in the evaluation of different strategies for monetary policy. Froyen and Guender (2000) find that the case for nominal income targeting is not so clear-cut in a small open economy where the exchange rate has direct effects on both aggregate demand and aggregate supply. However, they do not consider overall price level targeting as an alternative strategy to nominal income targeting, a fact which motivates this paper.

III. A Small Open Economy Model

The model adopted in this paper builds on that proposed by Turnovsky (1983) and Froyen and Guender (2000). The model incorporates important features of a small open economy. Firstly, the exchange rate is incorporated into both the demand and supply side relations. Secondly, the model takes account of the fact that in a small open economy the general or overall price level serves as the measure underlying the calculation of the rate of

[8] It should be mentioned that McCallum and Nelson's favourable evaluation of the performance of nominal income targeting relative to inflation targeting derives from the choice of country and their definition of the rate of inflation. Firstly, their study is based on US data. Clearly, the United States is not a small open economy. Secondly, McCallum and Nelson define inflation as log changes in the domestic price level. In a small open economy, a more preferred measure of the rate of inflation is the log change in a more comprehensive price index (such as the CPI) that also includes the price of imported foreign goods and the exchange rate.

inflation. As a central bank is concerned primarily with stability in the *general* level of prices, the central bank's goal variable should not be solely the domestic price level but the measure of overall prices. That central banks are in fact concerned with stability in a comprehensive price index is evident from Table 1. All countries that have adopted inflation targeting measure inflation on the basis of changes in the overall price level, such as the CPI, and not the GDP deflator.

The model consists of the following five equations. All variables, apart from the nominal interest rate, are expressed in logarithms. All parameters are positive.

$$c_t = (1-\alpha)\, p_t + \alpha\,(x_t + p_t^f) \tag{1}$$

$$y_t = -a_1\,(r_t - (c^e_{t+1,\,t} - c_t)) + a_2\,(p_t^f + x_t - p_t) + v_{1t} \tag{2}$$

$$m_t - c_t = \gamma_1\,(y_t + p_t - c_t) - \gamma_2 r_t + v_{2t} \tag{3}$$

$$y_t = b_0 + b_1\,(p_t - x_t - p_t^f) + b_2\,(p_t - w_t) + u_t \tag{4}$$

$$r_t = r_t^f - x_t + x^e_{t+1,\,t} + \varepsilon_t \tag{5}$$

c_t = the overall price level

$c^e_{t+1,\,t}$ = the expectation of c_{t+1} formed at time t

p_t = the aggregate domestic price level

p_t^f = the foreign price level

x_t = the spot exchange rate

$x^e_{t+1,\,t}$ = the expectation of x_{t+1} formed at time t

r_t = the domestic nominal interest rate

r_t^f = the foreign nominal interest rate

y_t = real output

m_t = the nominal money supply

w_t = the money wage

v_{1t}, v_{2t},u_t, and ε_t are white noise disturbances with variance σ^2_{v1}, σ^2_{v2}, σ^2_u and σ^2_ε respectively.

Equation (1) defines the overall price level as a weighted average of the domestic

price level and foreign price level (after adjusting for movements in the exchange rate). Equation (2) defines the IS relation: real output demanded depends on the expected real interest rate and the real exchange rate. Equation (3) is the LM function for an open economy: the money supply and the value of nominal domestic output are deflated by the general price level.

Equation (4) is the aggregate supply (AS) relationship. Output is produced by profit maximising firms with the help of a labour input and an intermediate input imported from abroad. Output supplied responds negatively to the prices of the two factors of production.[9] Nominal wages are set in advance, at time t-1, by equating expected labour demand to expected labour supply, both parameterised by expectations of next period's price level. The presence of an intermediate good reflects the current trend towards vertical specialisation of production and underscores the importance of exchange rate effects on aggregate supply.[10]

Equation (5), the uncovered nominal interest parity condition, reflects the high level of integration of the financial sector of a small open economy with the rest of the world.

To close the model, we consider the following different strategies for monetary policy:

$$m_t = m^* + \lambda_1(x^* - x_t) \quad (6)$$

$$m_t = m^* + \lambda_2 (c^* - c_t) \quad (7)$$

$$m_t = m^* + \lambda_3(Y^* - (p_t + y_t)) \quad (8)$$

Equations (6), (7) and (8) allow the money supply to respond to deviations from target levels of the exchange rate, the overall price level and nominal income respectively. λ_1, λ_2, and λ_3 are policy rule parameters, the value of which determines the form of policy rule a central bank follows. A rule to target the exchange rate would see λ_1 tend to infinity while a rule to target the overall price level (nominal income) would let λ_2 (λ_3) approach infinity. A rule to target the money supply would see λ_i (i=1, 2, 3) tend towards zero.[11]

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[9] Notice that the (log) inverse of the two factor prices appears in equation (4). For a derivation of this equation, see Marston and Turnovsky (1984), Marston (1985) or Benavie and Froyen (1991). Notice also that we do not make a distinction between the price of the imported intermediate good and the imported consumption good; instead we use p^f_t to denote the price of the foreign good. The price of the foreign good is treated as a stochastic variable with mean zero and constant variance σ^2_{pf}.

[10] See Feenstra (1999) for a discussion of the changing pattern of international trade and the increasing importance of trade in intermediate goods.

[11] The distinction between using the money supply or the nominal interest rate as the instrument is of no relevance here. This is due to the assumption that a particular target is achieved without error. If this assumption

Model solution

To solve the model, first one of the policy rules and the uncovered interest rate parity condition are substituted into the LM equation. Then LM is solved for the exchange rate and the result substituted into IS, yielding aggregate demand. Next the exchange rate is substituted into aggregate supply. Setting aggregate demand equal to supply gives a solution for the domestic price level and output. Using the method of undetermined coefficients, trial solutions are postulated for y_t and p_t of the following form (not including constant terms):

$$y_t = \pi_{11}v_{1t} + \pi_{12}u_t + \pi_{13}v_{2t} + \pi_{14}\varepsilon_t + \pi_{15}r_t^f + \pi_{16}p_t^f \quad (9)$$

$$p_t = \pi_{21}v_{1t} + \pi_{22}u_t + \pi_{23}v_{2t} + \pi_{24}\varepsilon_t + \pi_{25}r_t^f + \pi_{26}p_t^f \quad (10)$$

That is, the domestic price level and output can be expressed as functions of all stochastic variables in the system. The resulting solutions for the domestic price level and output are then substituted into the exchange rate equation to solve for the equilibrium exchange rate in the following form:

$$x_t = \pi_{31}v_{1t} + \pi_{32}u_t + \pi_{33}v_{2t} + \pi_{34}\varepsilon_t + \pi_{35}r_t^f + \pi_{36}p_t^f \quad (11)$$

In order to investigate the relative merits of exchange rate targeting, nominal income targeting and overall price level targeting, we let λ_1, λ_2 and λ_3 tend towards infinity. For money supply targeting we set λ_i equal to zero.[12]

IV. Evaluating Policy Rules

To determine which policy rule should be the central bank's choice, we need to specify the framework underlying the evaluation of the policy rules. It is standard practice to assume that the central bank wishes to maintain stability in output and the price level. This motivates

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were dropped, then policy would have to be aimed at the forecast of the target variable, which would arguably reduce the merits of nominal income targeting.

[12] The solutions for the π_{ij}s in the respective equation for p_t and x_t under each policy rule appear in the appendix which is available from the authors upon request.

the specification of a loss function that includes deviations of real output and the general price level.[13]

In keeping with the accepted practice of modelling losses symmetrically, we adopt a loss function of the following form:

$$L_t = A\, c_t^2 + (y_t - y^*)^2 \qquad (12)$$

where

$$c_t = (1-\alpha)\, p_t + \alpha\, (x_t + p_t^f)$$

In the loss function A represents the relative weight assigned to the overall price level objective. The target price level has been normalized to zero. This normalisation is inconsequential as we have assumed a *static* framework where there is no distinction between inflation and price level targeting.[14] Output losses are defined as deviations from capacity output y^*.[15] The implied coefficient on y^* is one, which eliminates inflationary bias issues.[16]

Tables 2 and 3 give the coefficients of the equation for the level of real output and the overall price level, respectively. It is apparent that real output and the overall price level are not disturbed by money demand shocks under exchange rate, overall price level, or nominal income targeting. This is due to the money supply adjusting to maintain the target values, which in turn stabilises aggregate demand without changing the domestic interest rate or exchange rate. Therefore, the level of real output and the overall price level are unchanged.

In Table 2 one result is striking and deserves closer scrutiny. Under nominal income targeting the size of b_1 plays a pivotal role in stabilising the level of real output. The size of b_1

[13] The alternative method of evaluating policy rules is to use a representative household's utility function, an approach taken by Ireland (1998). Using this approach, he finds price level targeting outperforms nominal income targeting and money supply targeting.

[14] As we assume that the central bank hits the pre-determined target for the price level without fail, the distinction between price level targeting and inflation targeting becomes immaterial. See Rodseth (1996). For a comparison between price level and inflation targeting in a *dynamic* framework the reader is referred to Svensson (1999).

[15] One could argue that in the loss function the desired level of real output ought to vary in accordance with shocks to the real exchange rate or productivity. However, as the disturbances are temporary and as changing output is costly, we assume that the policymaker aims to hold the level of real output fixed.

[16] Though as an economy becomes more open, the inflationary bias decreases anyway, as noted by Hardouvelis (1992), and Guender and McCaw (1999).

reflects the sensitivity of output *supplied* to changes in the real exchange rate. In the event that $b_1 = 0$, nominal income targeting perfectly stabilises real output in the face of IS, UIP, and foreign price level disturbances. This is a standard result in models of the closed economy. Moreover, this result carries over to the open-economy framework provided that only *domestic* factors of production are combined to produce output. Once an intermediate input that is imported from abroad figures in the determination of output supplied, b_1 is greater than zero. As a consequence, output supplied becomes sensitive to changes in the real exchange rate. Open-economy models that ignore these exchange rate effects on aggregate supply thus tend to overestimate the ability of nominal income targeting to stabilise the level of real output (and the domestic price level) in the wake of IS, UIP, and foreign price shocks.

Otherwise, few concrete results emerge from comparing the coefficients of the shocks in either the output equation or the overall price level equation. Looking at Table 2 and abstracting from money supply targeting for the moment, we find that from the standpoint of output stabilisation nominal income targeting still dominates both exchange rate and overall price level targeting even if $b_1 > 0$ in the face of IS and UIP disturbances. In the case of an aggregate supply disturbance, exchange rate targeting insulates output better than overall price level targeting. No definitive rankings of the policy rules exist for foreign price level shocks.

By definition, overall price level targeting dominates both exchange rate and nominal income targeting from the standpoint of stabilising the overall price level. Again the size of b_1 is important. According to Table 3, the response of the overall price level under a strategy of nominal income targeting becomes more pronounced the greater the size of b_1 in the face of IS and UIP shocks. In contrast, the response of the overall price level becomes more muted under exchange rate targeting for IS and UIP shocks as b_1 increases in size. Larger values for b_1 cause larger displacements in the overall price level relative to target under both nominal